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ABSTRACT

This report outlines the activities of the Study of Mathematically Precocious Youth (SMPY) in four areas: (1) Discovery (finding the talented); (2) Description (further study of the ablest of them); (3) Development (helping the talent-search participants educationally); and (4) Dissemination (helping others use SMPY's principles, practices, and programs). (Author/MK)

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# Seventh Annual Report to The Spencer Foundation Concerning Its Support of the Study of Mathematically Precocious Youth (SMPY) at The Johns Hopkins University During the Period 1 September 1977 through 31 August 1978

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This seventh year of SMPY's existence has been by far its busiest and most productive yet. Activities have moved rapidly along all of the $D^4$ fronts: Discovery (finding the talented), Description (further study of the ablest of them), Development (helping the talent-search participants educationally), and Dissemination (helping others use SMPY's principles, practices, and programs). The fifth annual mathematics talent search was conducted. The highest-scoring 15 percent of its 2800 students were tested further. Many things were done to facilitate the educational development of a large number of the approximately 7000 mathematically talented youths SMPY has identified thus far. SMPY's principles, practices, techniques, and programs were disseminated across the country and abroad. Many students not in the talent search's geographical area (the Middle Atlantic States) were reached, also. In this report we shall discuss a number of happenings during the year to show the breadth and depth of SMPY's emphasis on educational acceleration of youths who reason unusually well mathematically and are eager to move ahead.

## The First D: Identification of Talent

Since its first talent search in March of 1972, SMPY's chief measure of mathematical reasoning ability has been score on the mathematics part of the College Board's Scholastic Aptitude Test (SAT-M). This secure but readily available test is meant for the upper half of eleventh- and twelfth-graders, but SMPY has found it virtually ideal for differentiating among the top 3 percent of seventh graders. On the 60 items they score all the way from nearly chance to nearly perfect. More than a fourth of the boys who enter the talent search score higher on SAT-M than the average collegebound male twelfth-grader does, and the talent-search girls do at least that well when compared to collegebound twelfth-grade females.

For its fifth annual talent search SMPY used the national testing facilities of the College Board, especially the 28 January 1978 examining. All mathematically

upper-3-percent youths attending the seventh grade in Delaware, the District of Columbia, Maryland, Pennsylvania, Virginia, or West Virginia or, if in a higher grade, born not earlier than 1 January 1965, were eligible. The total number participating was 2799, up from 873 in December of 1976. The distributions of their scores on SAT-M, SAT-Verbal, and the Test of Standard Written English (TSWE) are shown,separately by sex, in Figures 1, 2, and 3. As has been found in each talent search thus far, the boys tend to score better on SAT-M than the girls do, but little different on SAT-V. The two sexes are also similar on TSWE, administered to talent-search participants for the first time in January of 1978. Professor Lynn H. Fox, who heads the Intellectually Gifted Child Study Group at Johns Hopkins, is studying why the sex-related SAT-M difference occurs. Societal restrictions and absence of suitable role models for girls seem strongly implicated.

SMPY's criterion for excellent mathematical reasoning ability is an SAT-M score of 500, which is just above the mean of collegebound twelfth-grade males (494 in 1977-78). Some 26 percent of the boys and 13 percent of the girls scored that high. This is the mathematical-reasoning level of about the top 1 percent of seventh-grade males. Such youths can master the courses in mathematics and related subjects (especially physics, chemistry, and computer science) far faster and better than their less-apt agemates. It is for this level of mathematical reasoning ability that SMPY is especially concerned about opening up special educational opportunities. Primarily for such students the "smorgasbord of special educationally accelerative opportunities" was pioneered by SMPY.

## The High-Verbal Group

Nevertheless, all students who participate in the talent search get much counseling by mail. Also, those who score high on SAT-V and/or TSWE are honored and told about special opportunities to use their verbal talents. (Of course,

quite a few participants score high on two or even three parts of the SAT.) After years of effort, SMPY finally persuaded three liberal-arts departments at Johns Hopkins to offer special courses on Saturdays during the academic year to the verbally talented participants in the talent search. For 1978-79 these are two sections of Expository Writing, offered by the Writing Seminars; one section of Greek and Latin in Current Use, offered by the Department of Classics; and one section of German, offered by the Department of German. This is a notable "first" that should permit considerable expansion in the years ahead. The writing course is aimed toward the English Composition Test of the College Board. The Greek and Latin course should help the students in a number of ways, including some influence on their later SAT-V scores, but mainly it is meant to "enrich" their vocabulary. The German course, probably to be continued for a second year with many of the same students, should lead to high-school credit and, for the best students, college credit via the two Advanced Placement Program examinations in German.

## The Awards Ceremony

On 23 April 1978 an overflow crowd of about 1500 persons, participants in the January 1978 talent search and their families, teachers, and friends, met in the auditorium of Shriver Hall on the Homewood Campus of The Johns Hopkins University to celebrate talent in mathematical reasoning, verbal reasoning, and English composition. A number of eminent persons, including Senior Senator Richard S. Schweiker of Pennsylvania (whose daughter was a high-scorer) and Dr. Dorothy Sisk, Director of the Office of the Gifted and Talented in the U.S. Office of Education, spoke briefly. Every participant in the talent search received a handsome certificate. Some certificates indicated exceptional score(s) in one or more of the three areas. A total of 1500 books were given in recognition of high potential. One hundred and thirty-nine scholarships, each good for one college course, were presented to the highest scorers on SAT-M. The schools from which the highest

scorers came were honored, too. Everyone attending seemed extremely pleased with the awards program.

## Further Study of the High Scorers

Two hundred and ninety-eight of the top-scoring participants in SMPY's academic-year 1977-78 talent search were tested considerably more, some of them on Saturday, October 14, and the others on Sunday, October 22 (the two different dates being for the convenience of the students). The criteria for being invited back for this further testing were as follows:

SAT-M $\geq$ 550

or SAT-V $\geq$ 580

or TSWE $\geq$ 58

or SAT-M $\geq$ 500 and SAT-V $\geq$ 430.

The tests administered were as follows:

Differential Aptitude Test: Space Relations

Differential Aptitude Test: Mechanical Reasoning

Sequential Test of Educational Progress (STEP II): Science Level I, Form A

Sequential Test of Educational Progress (STEP II): Science Level I, Form B

Strong-Campbell Interest Inventory

and either Cooperative Achievement Test Algebra I or Algebra II or Algebra III or College Board Physics Achievement (according to level of knowledge).

This second of SMPY's three D's, "Description," strongly supplements the identification process and leads to better carrying out of the third D, "Development," which is chiefly educational facilitation in mathematics and related subjects such as physics, chemistry, and computer science. Of course, all partici-

pants in the talent searches get considerable facilitation in the form of a long memorandum from SMPY and a number of shorter memorandums that set forth in considerable detail various ways to move ahead better and faster than the usual pace of the student's age-in-grade class. Only a relatively few of the participants can actually come to the Johns Hopkins campus for special instruction or fast-paced tutoring. Those who do seem to benefit greatly. An especially successful instructional venture with a considerable number of the top scorers from the 1976-77 and 1977-78 talent searches is described in the following section.

## SMPY's Summer-of-1978 Fast-Math Classes

During the eight-week period 20 June - 10 August 1978 there were two sets of fast-paced mathematics classes on the Johns Hopkins campus. One of these, for participants in the December 1976 SAT testing (most of them 11-12-year-old seventh-graders at that time), met on Tuesdays and Thursdays for 3-5 hours each day. The other set of classes met on Wednesdays for five hours and enrolled chiefly 10-13-year olds from the January 1978 SAT testing. There were 43 math participants in the TuTh group and 33 in the W group. Also, on TuTh 54 students began studying chemistry and/or physics with a view to taking the Advanced Placement Program examinations in them for college credit some May during the next few years.

Thus, in the TuTh classes the typical student had recently completed the eighth grade. In the W class most had finished the seventh grade. The formal mathematics preparation of 23 of the former consisted of only first-year algebra in a junior high or middle school. For the latter, only 8 had taken that beginning course in precalculus. They were remarkably able, however. The TuTh group was formed from among 97 of the highest-scoring of the 507 males (themselves upper-3% in mathematical aptitude) who participated in SMPY's 1976-77 talent search. That was done on the basis of their scores on 13 difficult aptitude and achievement tests, which made them at least upper-1% of their age group in

overall mathematical and scientific aptitude. The 13 measures used were as follow: the mathematical and verbal portions of the Scholastic Aptitude Test (DAT); the abstract reasoning, spatial relations, and mechanical reasoning components of the Differential Aptitude Test (DAT); the natural science and mathematics portions of the American College Testing (ACT) Program; an algebra test; the STEP II (Sequential Test of Educational Progress) General Science tests, both forms; the College Board Physics Test; the analytical section of the GRE; and Bennett's Mechanical Comprehension Test.

Participants in the Wednesday class must have scored at least 600 on the mathematics part of the Scholastic Aptitude Test (SAT-M) and also at least 1100 for the sum of their SAT-M and SAT-Verbal scores.[1] Only 61 of the 2799 participants in the January 1978 testing scored that well, so these students were about the top 1 in 1000 of their age group nationally. Therefore, they were much more highly selected than the TuTh participants, but a year less advanced in age and, usually, in formal educational experiences.

Perhaps the most remarkable participant in the summer math classes was a ten-year-old from New Jersey who had not been discovered through SMPY's talent searches. At age 10 years 7 months he had scored 770 on SAT-M and 590 on SAT-V, a total of 1360. In our experience thus far his age-adjusted standing on SAT-M is second only to that of a Russian-immigrant boy in California who at age 10 years 0 months scored 780 and 540, respectively. If age is taken into consideration, the highest SAT-V + SAT-M scorer in SMPY's five talent searches thus far earned 750M and 710V at age 11 years 1 month. At age 10 years 1 month he had scored 680M and

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[1] One exception to this rule was made: an 11-year-old girl of Oriental background who scored 590 on SAT-M but 600 on SAT-V was enrolled in the W class, because she had already progressed well in mathematics on her own. This proved to be a wise decision. As of November 1978 she was still 11 and doing splendidly in SMPY's fast-paced college-level calculus class.

September 1978 a full
600V. Born on 3 November 1965, he is already a high-school graduate and as of/
sophomore at an outstanding university, majoring in physics and mathematics. This makes him almost as accelerated educationally as was Eric Robert Jablow (born on 24 March 1962), who entered Brooklyn College in the fall of 1973 at age 11 1/2 and was graduated summa cum laude with a major in mathematics at age 15 years 3 months. Eric, now 16, is a second-year doctoral student in mathematics at a top-flight university and doing extremely well, both educationally and socially. In October of 1978 he passed the general examinations for the Ph.D. degree, thus leaving only his doctoral dissertation to be done.

How much did the TuTh students accomplish in some 48-64 hours of instruction, as judged by their reaching at least the following percentiles on Educational Testing Service's Cooperative Achievement Tests in mathematics?: 90th %ile of national eighth-grade norms on Algebra I (i.e., scoring better than 90% of such students who have completed a regular school-year course in first-year algebra do); 85th %ile of national high-school norms on Algebra II, Algebra III (i.e., college algebra), plane geometry, and trigonometry; and 80th %ile of national high-school norms on analytic geometry. It must be kept in mind that these were quite able, though not necessarily intellectually brilliant, youths who have special aptitude for mathematics and somehow have usually learned much more of it than was presented in their classes at school. No claim is made that SMPY taught them all they knew. Rather, it afforded them the opportunity to consolidate their knowledge and fill in gaps so that they would score well on the standardized tests. The instructors in the summer session were, with one exception (our original teacher of fast-math classes), young students at Johns Hopkins who themselves were highly successful graduates of SMPY's earlier fast-paced mathematics classes. They were aided by a number of mathematically brilliant youths from SMPY's recent talent searches, one of whom was only 12 years old, but at age 11 years 1 month had scored 780 on SAT-M.

The numbers certified according to the above percentile standards are shown for the TuTh group in Table 1. For the W group, whose members were a year younger and received only about 40 hours of instruction, the numbers certified are also shown in Table 1. The most remarkable fact that leaps out at the reader from Table 1 is that 21 of the 43 TuTh students and 12 of the W students were ready to study high-school calculus, a difficult twelfth-grade subject, by the end of the summer when they would "normally" become only eighth- or ninth-graders. At the start of the summer they had ranged in age from 10 to 14. Because Algebra I is considered a 135-150-hour eighth-grade or ninth-grade subject for even the ablest students in the typical school, the extent of acceleration in mathematics that most of these students got in a few hours is truly astounding. It indicates how inappropriately slow the pace of even the better math classes usually is for youths in middle or junior high schools who reason extremely well mathematically and are eager to move ahead. For example, SMPY has found that many students who score at least 500 on SAT-M when in the middle of the seventh grade can readily, with the help of a skilled fast-pacing young mentor, complete Algebra I better in 3-15 hours than they would a year or two later in 135-150 hours of regular instruction. The time saved, zest gained, and boredom and frustration prevented are priceless, and yet the school system has been saved much needless teaching time. Fast-paced mathematics can readily be a highly cost-effective bargain.

Nine of the students from SMPY's summer-of-1978 classes enrolled that fall in its fast-paced Sunday-afternoon calculus class, which is intended to help as many of those youths as possible to score well on the higher lever (BC) of the College Board's Advanced Placement Program calculus test in May of 1979. Fifteen others, chiefly from SMPY's December 1976 SAT testing of seventh-graders, are studying calculus under associate professor of mathematics Dr. Michael Razar at the University of Maryland, which is located more conveniently than Baltimore to the homes of those particular students. To go from pre-algebra I in June of 1978

Table 1: Accomplishments of the summer math program students according to the criteria of 85th %ile or better on national norms for the Educational Testing Service's Cooperative Achievement Tests in mathematics (80th %ile for analytic geometry)

| Course | Number of students certified up through and including the given course in each of the two programs | | Total |
|---|---|---|---|
| | Wed. | Tu.-Th. | |
| Algebra I | 1[a] | 1[b] | 2 |
| Algebra II | 4 (+1)[c] | 2 | 6 (+1) |
| Algebra III | 8 (+1)[c] | 3 (+1)[c] | 11 (+2) |
| Plane geometry | 4 | 10 | 14 |
| Trigonometry | 2 | 6 | 8 |
| Analytic geometry | 10 (+2)[d] | 17 (+4)[e,f] | 27 (+6) |
| No. of students in class | 29 (+4) | 39 (+5) | 68 (+9) |

[a] Spent only 4 weeks in the summer program.

[b] Was dropped from the program quickly because of failure to do the required work.

[c] One person was certified on the basis of overall achievement, even though the score was slightly below the criterion.

[d] Two persons were certified on the basis of overall achievement, even though the score was slightly below the criterion.

[e] Four persons were certified on the basis of overall achievement, even though the score was slightly below the criterion.

[f] Besides those 21 students who by the end of the summer TuTh fast-math program, chiefly after having completed only the seventh or the eighth grade, had been certified through the entire precalculus sequence, 10 others from the top 97 boys of the 507 males in the December 1976 SAT testing for the SMPY's mathematics search had also done so in other ways.

to college credit for calculus in May of 1979 would be an important step for the student and society.

## Future Fast-Paced Mathematics Classes

SMPY does not conduct such classes primarily as a service to the high scorers from its talent searches. Rather, they are meant to test the applicability of extreme speeding up of the learning of mathematics through the first two college semesters of the calculus so that school systems across the country will spare youths who reason extremely well mathematically the frustration, boredom, inattention, and lessened motivation that almost inevitably result from what is for them the snail pace of the regular school mathematics curriculum. SMPY has already conducted about a dozen such classes, usually one of a particular type followed by a replication of it with new students the next year. Several different approaches have been tried. All the classes thus far have been judged highly successful for many of the students enrolled. Some have had better "holding" power than others, partly because of the teacher and method used and the ability level of the students. Most recently, SMPY's DT→PI mentor model has emerged as a good combination of preliminary assessment ("diagnostic testing") followed by a combination of tutoring and lecture-demonstration with small groups ("prescriptive instruction").

Now that it has a number of experienced mentors, SMPY would like to try out the DT→PI model further during the summer of 1979 with about 120 excellent young mathematical reasoners. It has applied to the National Science Foundation for support of this summer program, to be followed by 30 sessions of college-level calculus during the school year 1979-80. If funded, this may be SMPY's final such bridge to the field. From then on, the SMPY staff will probably increasingly encourage school systems to set up their own accelerated procedures and perhaps "rent them a mentor" to help get fast-paced mathematics classes started.

## Getting College Credits Early

The staff of SMPY emphasizes the importance of gaining advanced standing and some college credits before becoming a full-time college student. It proposes two main ways to do this, taking college courses for credit "on the side" and preparing systematically for various Advanced Placement Program college-credit examinations offered by the College Board each May. Large numbers of SMPY's protégés have done the former, almost always quite successfully. The initial published report on this was by Solano, C. H., and George, W. C. 1976. College courses and educational facilitation of the gifted. Gifted Child Quarterly 20(3, Fall): 274-85. Tables 2-6 of the present report represent an updating of information concerning the achievements of the early takers of college courses through the spring of 1978. These are minimum numbers, because undoubtedly there are other such course takers about whom we have not yet heard. The data are based on 160 males and 64 females of ages 9 to 18 at the time the course was begun.

As Table 2 shows, the boys took 394 courses at average age 14.6 years and having average SAT-M score 628, with total GPA 3.57 on a scale where 4.00 is A and 3.00 is B. The girls took 131 courses at average age 16.1 and having average SAT-M score 550, with their overall GPA being 3.36. Thus, these girls were considerably older than the boys, less able, and less good students (though 3.36 is excellent). More than twice as many of these students of either sex made A's, the modal grade, as B's. Out of 525 courses there were only 38 grades less than B, and 34 of those were C's. This is indeed a remarkable record!

Table 3 shows some trend for those students who scored lowest in this group on SAT-M to make poorer grades than the rest, but from 550 upward there is no systematic trend.

Table 4 reveals that the students taking courses at community colleges were the least able of this group (but their SAT-M mean was 586) and made the best grades. The poorest total GPA (3.46) was earned at universities by the highest-

Table 2: Course Grades for SMPY Students by Sex

| | A | B | C | D | F | # Courses | N | GPA | Age | SAT-M* |
|---|---|---|---|---|---|---|---|---|---|---|
| Males | 257 | 119 | 15 | 2 | 1 | 394 | 160 | 3.57 | 14.6 | 628 |
| Females | 75 | 36 | 19 | 1 | 0 | 131 | 64 | 3.36 | 16.1 | 550 |
| Total | 332 | 155 | 34 | 3 | 1 | 525 | 224 | 3.51 | 15.0 | 612 |
| (%) | 63 | 30 | 6 | 1 | 0 | 100 | | | | |

*SAT-M scores unavailable for 53 courses (17 males and 36 females)

Table 3: Grade-Point Average by SAT-M Score

| SAT-M* | GPA | # Courses | % Courses |
|---|---|---|---|
| 400-449 | 2.43 | 2 | 0 |
| 450-499 | 3.13 | 41 | 9 |
| 500-549 | 3.48 | 61 | 13 |
| 550-599 | 3.74 | 84 | 18 |
| 600-649 | 3.61 | 112 | 24 |
| 650-699 | 3.70 | 92 | 20 |
| 700-749 | 3.54 | 49 | 10 |
| 750-800 | 3.71 | 28 | 6 |

*SAT-M scores unavailable for 53 courses

Table 4: Grade-Point Average and SAT-M by College Type

| | GPA | SAT-M* | # Courses | % Courses |
|---|---|---|---|---|
| Community College | 3.62 | 586 | 79 | 15 |
| College | 3.52 | 605 | 190 | 36 |
| University | 3.46 | 632 | 256 | 49 |
| Total | 3.51 | 612 | 525 | 100 |

*SAT-M scores unavailable for 53 courses

Table 5: Grade-Point Average by Type of Course

| | GPA | SAT-M* | # Courses | % Courses |
|---|---|---|---|---|
| Mathematics | 3.62 | 627 | 175 | 33 |
| Computer Science | 3.58 | 635 | 97 | 18 |
| Social Sciences | 3.45 | 577 | 71 | 14 |
| Natural Sciences | 3.43 | 614 | 66 | 13 |
| Humanities/Fine Arts | 3.36 | 573 | 116 | 22 |
| Total | 3.51 | 612 | 525 | 100 |

*SAT-M scores unavailable for 53 courses

Table 6: Grade-Point Average by Age

| | GPA | SAT-M* | # Courses | % Courses |
|---|---|---|---|---|
| 9 | 2.00 | 730 | 2 | 0 |
| 10 | 3.33 | 700 | 3 | 1 |
| 11 | 3.58 | 655 | 4 | 1 |
| 12 | 3.72 | 664 | 17 | 3 |
| 13 | 3.77 | 652 | 62 | 12 |
| 14 | 3.62 | 640 | 124 | 24 |
| 15 | 3.66 | 622 | 102 | 19 |
| 16 | 3.43 | 577 | 98 | 19 |
| 17 | 3.44 | 558 | 99 | 19 |
| 18 | 3.23 | 508 | 14 | 3 |

*SAT-M scores unavailable for 53 courses

scoring set of students, but of course there is considerable confounding of type of higher institution with difficulty of courses elected. In any event, neither the difference in SAT-M score nor in GPA between community colleges and universities is great (46 points on the former and 0.16 on the latter).

Table 5 shows that grades ran highest (3.62) in mathematics, which was the most-chosen field, and lowest in humanities and fine arts (3.36), which was the second most-chosen field. Students taking the math courses had scored considerably higher on SAT-M (627) than had those taking humanities and fine arts courses (573). The table provides no information about SAT-V scores, which would be expected to be less discrepant or even to favor the humanities and fine arts group.

Finally, Table 6 shows a somewhat curvilinear trend of age with respect to GPA. GPA's are rather steady within the age range 12-15, but lower at 9-11 and 16-18. Even then, only for the two courses taken at age 9 is the GPA less than 3.23. That brilliant boy's B in college algebra and trigonometry and D in Calculus I seemed due to immature study and attendance habits.

The total picture is eloquent support for encouraging youths who reason extremely well mathematically and are eager to get more intellectual stimulation than most schools can provide to take some college courses for credit long before the usual age of graduation from high school. Most of them would probably be wise to start with mathematics or computer science courses.

We do not yet have a similar table for Advanced Placement Program examinations, but have seen many such scores that gave the student credit for a college year of the course before he or she became a full-time college student. As our protégés get into senior high school we are emphasizing this opportunity. A few will qualify even before then. A few of the students will take college courses in a subject and also take the APP exam in it, because some of the most selective colleges in the country will accept few or no college-course credits from other institutions, but most will award advanced standing credit for high APP scores.

## Follow-Up Studies

SMPY has conducted two questionnaire follow-up studies of students from its talent searches. It is about to launch a third such study. The first such study (see a report on it in the Appendix) was based on those students who in the "normal" course of events would have graduated from high school by May or June of 1976. These were fairly high-scoring participants in the March 1972 talent search who were eighth- or ninth-graders then and those in the January 1973 search who were ninth-graders then. The second study was based on the presumed high-school graduating class of 1977. It is nearing completion. Cooperation from the survey subjects was excellent. By a combination of reminders and, in some instances, telephone interviews the percentage of locatable prospects who responded adequately was boosted to 98% for the first survey and 94% for the second.

Much valuable information, especially about the extent and kinds of educational acceleration among these able students, was obtained. Suggestions for improving SMPY's procedures were helpful. As expected, nearly all of these talent-search participants enter college in the fall immediately after finishing high school. Many of them attend the most selective colleges and universities in the country, especially those in the East. It will be fascinating to evaluate their college performance in a few years when the five-years-beyond-high-school questionnaires are sent.

Besides these formal surveys, the SMPY staff maintains a file folder for each participant in its talent searches who scored high enough to be invited back for further testing and many other persons, such as brilliant youths from outside the talent-search geographical area. Following up of many such youths, especially those who attend Johns Hopkins, is continual. These folders will help Dr. Stanley plan a case-study volume concerning "radical accelerants" that he hopes to prepare within the next few years.

## Dissemination Activities

Much of the time of the SMPY staff is spent in disseminating information about its techniques, principles, practices, and programs nationally. Its "dissemination table" contains more than 67 items that in various combinations are sent out to requesters all over the United States and in many foreign countries. This service enables many mathematically highly apt youths, aided by their parents, to plan educational programs that better meet their needs. It also helps educators provide better for such students. Much progress is being made toward a coordinated state-wide math-facilitation program in Illinois under the dynamic leadership of Joyce Van Tassel, the coordinator of activities for the gifted and talented in its public schools. Similar activities have been under way in the St. Paul-Minneapolis area for three years. SMPY has provided much on-the-spot consulting and counseling for these programs.

Of course, educational personnel in a number of counties in Maryland have been influenced strongly by SMPY's finding, studying, and educationally facilitating mathematically apt youths. Perhaps foremost among them are the public schools of Charles County, Howard County, Montgomery County, and Baltimore County. The Charles County program, headed by John Lunny, is a model for what can be done efficiently and economically in a small, non-urban county.

Other states, notably Hawaii and parts of Pennsylvania, are moving ahead rapidly with efforts to help the mathematically talented, and SMPY is giving them full support. Recently William C. George, SMPY's associate director, consulted in Honolulu with full representations of the state department of education and concerned parents.

It seems likely that the Carnegie-Mellon University in Pittsburgh will provide for its geographical area activities such as those pioneered by SMPY. We are corresponding with the provost, the director of teacher education, and others there, at their request. That fine institution is well equipped to make major contributions.

As each wave of publicity about SMPY's work crosses the country, dissemination activities are bound to increase until the point where hardly any sizable area of the nation will not have felt the influence of SMPY's proposed "smorgasbord of special educationally facilitative opportunities." This important aspect of SMPY's activities especially needs long-continued financial support. The staff of SMPY feels it would be unfortunate indeed to curtail dissemination for the next ten years, because its cumulative impact is almost certain to be enormous.

## Counseling

Thirty-two years ago Dr. Stanley took his master's degree at Harvard University in "educational and vocational counseling and guidance." It follows naturally from that and the nature of SMPY that those youths who score high in the annual talent searches get a great deal of individualized counseling from the staff of SMPY. As a comprehensive study, SMPY has no one "program." No two of its protégés are expected to follow quite the same pattern of educational facilitation and acceleration. Different mixes of aptitudes and achievements, different family situations, different geographical factors, and the like make much individualization essential.

In almost countless written and oral contacts with youths who reason extremely well mathematically, their parents, and their educators, the staff of SMPY from 1971 onward has accumulated a treasure trove of counseling "lore" that it is now trying to put into clear, didactic written form aimed at those three groups. This "counseling package" is expected to be ready by the summer of 1979. It will be the fourth such aid for the mathematically talented and those who work with them. The first three are due to appear in January of 1979 in a book entitled Counseling the Gifted Today, edited by Nicholas Colangelo and Ronald T. Zaffrann and published by Kendall/Hunt. They are entitled "Needles in a haystack: Identifying the mathematically gifted child,"by Cecilia H. Solano; "The Second D: Description of Talent," by Julian C. Stanley; and "A Component of the Third D: Fast-Math Classes,"by William C. George. A preliminary copy of each is included

in the appendixes to this report.

## Publications

Publications by staff members of SMPY during this period (September of 1977 through August of 1978) include the following two books, each of which was edited by Julian C. Stanley, William C. George, and Cecilia H. Solano: The Gifted and the Creative: A Fifty-Year Perspective, published by The Johns Hopkins University in late 1977; and Educational Programs and Intellectual Prodigies, published by SMPY in 1978. The manuscript for another major book, edited by William C. George, Sanford J. Cohn, and Julian C. Stanley and entitled Acceleration and Enrichment: Strategies for Educating the Gifted, is being reviewed by a major publisher.

Besides the ten issues of ITYB (SMPY's Intellectually Talented Youth Bulletin) that appeared during this period (see the appendix for a copy of each of those) and contained much writing by the SMPY staff, the following articles came out:

Cohn, S. J. 1977. Cognitive characteristics of the top-scoring third of the 1976 Talent Search contestants. ITYB 3(10, July): 3-6. Reprinted in Gifted Child Quarterly, 1978, 22(3, Fall): 416-21.

Fox, L. H., and Stanley, J. C. 1977. A university responds to the plight of intellectually talented youths. MAHE (Maryland Association for Higher Education) Journal 2(1): 2-5.

George, W. C. 1977. Parental support: Time and energy. Gifted Child Quarterly 21(4, Winter): 555-57.

Stanley, J. C. 1977. Radical Acceleration: Educational innovation at Johns Hopkins University. Gifted/Talented Education 2(4, October): 1-3. Also published as "Radical acceleration: Recent educational innovation at JHU" in Gifted Child Quarterly, 1978, 22(1, Spring): 62-67.

_____. 1977-78. The predictive value of the SAT for brilliant seventh-and eighth-graders. College Board Review 106 (Winter: 30-37.

_____. 1977. Gather ye APP credits while ye may . . . ITYB 3(10, July 15): 12-14. Reprinted in the Gifted Child Quarterly, 1978, 22(1, Spring), 129-32.

_____. 1978. Educational non-acceleration: An international tragedy. G/C/T 1(3, May/June): 2-5, 53-57, 60-64.

_____. 1978. Finding the ablest mathematical reasoners in a specifically designated group. In A. Y. Baldwin, G. H. Gear, and L. J. Lucito (eds.), Educational planning for the gifted: Overcoming cultural, geographic, and socioeconomic barriers. Reston, Va.: Council for Exceptional Children.

_____, and George, W. C. 1978. Now we are six: The ever-expanding SMPY. G/C/T (i.e., Gifted/Creative/Talented Children) 1(1, January/February): 9-11, 43-44, 50-51.

Stark, E. W., and Stanley, J. C. (eds.). 1978. Bright youths dispel persistent myths about intellectual talent: Panel discussion with parents and educators. Gifted Child Quarterly 22(2, Summer): 220-34.

## Conferences Attended

SMPY is represented at many local, regional, and national meetings, though of course the smallness of its staff precludes accepting most invitations to speak. For example, Dr. Stanley, Mr. Cohn, and Mr. George were on the program of the National Association for Gifted Children in San Diego in October of 1977 with a workshop, a major address, and a research paper. In July of 1978 Dr. Stanley spoke to a total of 450 educational administrators in the national week-long training institutes in Georgia, Missouri, and Colorado that are sponsored by the IDEA branch of the Kettering Foundation and directed by Dr. B. Frank Brown. He also delivered an invited address in August of 1978 at the annual meeting of the American Psychological Association in Toronto as the winner of the Edward L. Thorndike Award for Distinguished Psychological Contribution to Education.

Mr. George was extremely active, especially in Illinois, Minnesota, and Hawaii. With his help, Joyce Van Tassel, coordinator of state department of education activities on behalf of the gifted and the talented in Illinois, is replicating the SMPY find-study-help model there on a statewide basis. He has also been actively involved in helping a five-state Midwestern consortium (including, besides the above two, Ohio, Michigan, and Wisconsin).

He was also an invited speaker at the 5-state Northeast Exchange Research Conference. Mr. Cohn was a major member of Dr. Dorothy Sisk's national task force on the gifted; at her invitation he developed a comprehensive model for giftedness and discussed it widely.

## Facilitating the Learning of Physics and Chemistry

Although SMPY's emphasis is on mathematics, youths who reason extremely well mathematically are encouraged systematically to prepare for Advanced Placement Program examinations in physics (Level C), chemistry, and also biology as soon as feasible so that they can enter college with sophomore standing in mathematics and the sciences. With help from the Dreyfus and the Dodge Foundations, a major initial effort in this direction was made for chemistry and physics for 54 students during the summer of 1978. This was in conjunction with the fast-paced summer classes in mathematics, though not all of the 54 were enrolled in them (some had already mastered precalculus by the end of the eighth grade). While in its early stages and still being studied to provide a basis for further action, this widening of SMPY's scope seems likely to have considerable positive effect on the educational progress and attainments of mathematically highly apt youths.

## Educational Training in SMPY

Since its inception in September of 1971 SMPY has had a strong training role, both for specialists in the education of intellectually talented youths and for others who work with its staff while majoring in some other area such as psychology or mathematical science. Thus far, three persons have earned their Ph.D. degrees in psychology while working in SMPY for several years: Daniel P. Keating (October 1973), now an associate professor of child development at the University of Minnesota; Lynn H. Fox (May 1974), now an associate professor of education in the Evening College and Summer Session at Johns Hopkins; and Cecilia H. Solano (May 1977), now an assistant professor of psychology at Wake Forest University. Drs. Fox and Keating are rapidly becoming nationally prominent, and Dr. Solano seems well on her way also.

Drs. Fox, Keating, and Solano also earned master's degrees in psychology at Johns Hopkins, as did Sanford J. Cohn, Camilla P. Benbow, Susanne A. Denham,

and Linda Kanter Greenberg. Besides these, five of the six Johns Hopkins BA/MA candidates in psychology, all of whom received both of those degrees in May of 1978, were on SMPY's staff part-time for many months. Two of these, Betsy Jane Becker and Leonard A. Kusnitz, did their master's theses under Dr. Stanley's direct supervision. Others collaborated with Dr. Stanley or other SMPY staff members on research papers. For example, Mr. George and Ann R. Eisenberg (now a doctoral student in psychology at the University of California, Berkeley) have in press for College and University an article entitled "Early Entrance: The Johns Hopkins Experience." It was accepted for publication the same week it was submitted. It will appear in the 1978-79 winter issue of that publication.

The staff of SMPY is proud of its training role, because the best disseminators of its ideas are likely to be those persons trained on the premises in the midst of the various activities. We suspect that a main reason why Lewis M. Terman's monumental study did not have even more continuing influence than the great amount it did was Terman's failure to attract persons interested primarily in intellectual talent. Only four doctoral dissertations done under him during his long period of service at Stanford University concerned any aspect of high intelligence. When Mr. Cohn receives his doctorate at Johns Hopkins in 1979 or 1980, SMPY will already have produced that many doctoral recipients, most of them far more involved with intellectual talent (especially educational facilitation of brilliant youths) than Terman's four doctoral students were.

## Personnel Continuity and Changes

Working with SMPY during the year commencing on 1 September 1977 were Dr. Stanley, Mr. George, Mr. Cohn, Ms. Benbow, Ms. Lois S. Sandhofer, Ms. Laura M. Thommen, and a number of student assistants, notably Ms. Betsy J. Becker and Ms. Catherine M. Gore. Mr. George, the only full-time member of the staff, continued to function as associate director of SMPY, coordinator of its talent searches,

treasurer, and budget officer. Mr. Cohn served as assistant director, coordinator of data processing, and editor of SMPY's ten-times-per-year Intellectually Talented Youth Bulletin (ITYB), which goes all over the country to persons interested in the gifted. Ms. Benbow worked with Mr. Cohn on a considerable number of things, including follow-up studies. She is taking over the editorship of ITYB. Ms. Sandhofer, administrative assistant and secretary of SMPY, and Ms. Thommen, her invaluable assistant, helped with nearly all aspects, including dissemination of information by telephone and mailing out of a number of materials specially prepared by SMPY.

Ms. Gore completed her B.A. degree in mathematical sciences and her Ed.M. degree in giftedness with Professor Fox concurrently, receiving both from Johns Hopkins in May of 1978. She joined the SMPY staff half-time during the summer of 1978 as supervisor of its educational activities and in September moved to a three-quarter-time basis. Ms. Gore is an excellent data analyst, also. Ms. Becker completed her BA and MA degrees in psychology concurrently and left in the fall of 1978 to become a doctoral student in educational measurement at the University of Chicago.

Others who worked a great deal with SMPY while earning their BA/MA degrees were Ann R. Eisenberg (who completed everything in three years at age 20!) and Karen J. Feinstein. Both are now doctoral students in psychology, Ann at the University of California (Berkeley) and Karen at Vanderbilt University. Though neither of these remarkable young ladies plans to devote her main efforts to the field of intellectual talent or even differential psychology, they have done excellent research in the field and will be likely to further SMPY's aims appreciably.

## SMPY's Goals

SMPY is doing so many different things for such large numbers of mathematically apt students--and for some verbally apt ones, also--that it is not feasible to discuss them all here. The materials in the appendixes to this report will help

indicate the scope of our efforts. Obviously, each aspect of the $D^3$ model set forth in SMPY's first book (Mathematical Talent: Discovery, Description, and Development, Johns Hopkins University Press, 1974) has been, and is still being, explored in both depth and breadth. Large numbers of youngsters who reason well mathematically and/or verbally are being "discovered." The ablest of these are being studied further in order to "describe" their characteristics better and provide information on which to base special educational efforts on their behalf. That special educational facilitation helps the "development" of the youths who are eager to move ahead faster and better than is permitted in most curricula of public and private schools.

To these three D's we have added a fourth, Dissemination, as SMPY's principles, procedures, and programs are broadcast across the country and into other lands. Because of the direct link between SMPY and the individual talented child and/or his parents or teachers, the amount of change effected in many communities, school districts, and states during SMPY's seven-year existence thus far is almost unbelievably large. The usual twenty-year lag between innovation or discovery and use had been reduced drastically, because SMPY does not try to work down through the educational hierarchy, but instead works up from the talented person himself or herself. In effect, SMPY is a catalyst for change that will help the talented individual directly, substantially, and immediately, rather than hoping that a school system will eventually develop a "program for the gifted" which will benefit that person's younger siblings or his own children or grandchildren a little. We are impatiently contemporary, dedicated to strong special provisions now and demonstrating a wide variety of cost-effective ones.

SMPY's main activities remain educationally accelerative. We have not found so-called educational enrichment suitable for math-talented youths over the school years unless it leads to subject-matter and/or grade acceleration. For example, an able student who has had a splendid "unified math program" in Grades

K-7 will almost surely be terribly bored if required to take first-year algebra as an eighth grader, and yet this kind of failure to articulate curricula at different grade levels is common where "enrichment" is used. (More likely, there won't be a well-sequenced math progaam for the abler students even from kindergarten through the seventh grade.) We hope that our new book (Acceleration and Enrichment: Strategies for Educating the Gifted) will help show parents, educators, and intellectually talented youths how unfairly ruled out accelerative options are in most schools, both public and private, and encourage insistence on them where needed. SMPY has helped stiffen many parental backbones in preparation for demanding that their intellectually talented children be given the flexibility they need and want. It has helped educators sympathetic with the plight of the ablest of their students to break through the "social and emotional development" shibboleth that greatly favors "enrichment" to the exclusion of acceleration. It has provided insight and hope for the intellectually talented youths themselves and encouraged some of them to take over a great deal of their own educational decision-making at an early age.

Thus, in pseudo-mathematical form SMPY's activities may be described as $D^4P^3A$: Discovery, Description, Development, and Dissemination of Principles, Practices, and Programs leading to various kinds of educational Acceleration.

## Plans for the Future

With the completion of its eighth year, on 1 September 1980, the staff of SMPY will confine most of its efforts to three main activities: following up high scorers from the March 1972 first talent search onward through the sixth one, January 1979; counseling the high scorers on SAT-M in the future talent searches that will be conducted in January of 1980 and thereafter by Mr. William C. George as Director of the new Office of Talent Identification and Development under the provost's supervision at Johns Hopkins; and disseminating information about SMPY's findings to interested persons everywhere. It will also help create new fast-paced programs at Johns Hopkins.

This streamlining of function, urgently necessary because of the size to which SMPY's pool of talent-tested youths has grown (6500), includes turning over ITYB (the Intellectually Talented Youth Bulletin) to someone else. The ten-issues-per-year periodical has served excellently as a vehicle for relating intellectual talent to the subject matter of schools, which most specialists in the "gifted" and publications for them seldom do. (They favor "creativity" training or "fun and games" little related to the curriculum.) Arrangements for the transfer are not yet complete, but it is clear to the SMPY staff that it cannot go on devoting a considerable part of its limited time to ITYB, however admirable that publication may be. Also, a periodical with so broad a title should not be published by a specialized group such as SMPY.

We at SMPY would like to be endlessly innovative, but the harsh reality is that we are not staffed or equipped to pioneer many more programs and still provide adequate counseling, following-up, and dissemination. Instead, we must increasingly urge mathematics educators in school systems to try out our fairly well evaluated ideas and also do some innovation on their own. SMPY functions best with a small, highly interactive staff. It is not a service group, even though in developing its three P's a great deal of service is offered. Even at best, however, it could hardly take care of the needs in mathematics of the ablest students in a school system, much less in the whole country. For example, the typical coordinator of mathematics in a county school system in the Greater Baltimore area has considerably more staff than SMPY does. Quite a few school systems are already taking hold. We at SMPY wish that some professors of mathematics education seemed interested. They appear to be preoccupied with slow learners or preparing textbooks for large populations of students, which eliminates the highly talented from their main purview. At most, even during the headiest days of SMSG and other special mathematics programs inspired by Russia's sputnik the target population was the upper 20-33 percent of the age group, not the upper 3, 1, or 1/2 percent.

Many professors of mathematics seem greatly interested in youths who reason extremely well mathematically, perhaps largely because they themselves or a number of their friends and acquaintances were mathematical prodigies. Unfortunately, however, few such professors have the interest or detailed knowledge with which to carry off an undertaking such as SMPY.

Leading educational researchers, including educational psychologists, seem to have little interest in intellectually talented youth, nor do most developmental or differential psychologists. Those few who write about such students tend to seek answers to "Why?" questions, rather than emphasizing "What?", "How?", and "Whether" ones. The result is often devoid of obvious applicability to the education of brilliant youths. Instead, it is "research as usual," or speculations not anchored in sufficient data about clearly talented youths (see the review of SMPY's The Gifted and the Creative by Professor Michael Wallach of Duke University in the appendix for a strong statement about this.)

This preoccupation with "scientific" research to the exclusion of careful behavorial engineering leaves most intellectually talented youths rotting on the educational vine. In the 57 years since Lewis M. Terman began his perhaps unfortunately entitled "Genetic Studies of Genius" we have learned much about what "the gifted" are like, but all too little about how to help each intellectually talented youth use his or her abilities optimally. It seems to us a great shame that at only two major universities in the United States (Washington at Seattle and Johns Hopkins) are large numbers of real, live intellectually talented students being helped directly by university-based specialists in ways that contribute knowledge about how to facilitate similar youths in other places educationally. We hope The Spencer Foundation staff and trustees are proud that its grants started all three of those studies (headed by Halbert R. Robinson at Washington and Lynn H. Fox and Julian C. Stanley at Johns Hopkins). There are a few signs that professors at some other universities may be considering launching studies. Already a few college and

university faculty members do offer aid to their local school systems when educators try out SMPY's suggestions, but major initiatives are yet to come.

We at SMPY hope that the Spencer Foundation will continue to help us with counseling, following-up, and dissemination after our present grant expires on 31 August 1979. It has been heavily responsible for our rapid progress and unusual national visibility. We would like to see its name associated with our next phase of endeavor, which should bring SMPY's principles, practices, and programs to many school systems in this country and elsewhere.